

Planning for County Highways

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INTRODUCTION

More than 76,000 miles of roads are under county control in Indiana—a responsibility for county road authorities which almost defies measurement. The magnitude of the task is indicated, however, by two factors: annual expenditures, which in 1958 totaled over \$40 million, and employment, which totaled several thousand persons.

This responsibility places great problems on the 92 counties sharing the local road authority—problems which are ever on the increase as our population grows and motor travel mileage spirals upward. Because each county has different road needs and different capabilities, local problems vary. But one thing remains constant: the basic necessity of providing a system of roads to meet the demands of modern travel.

Solution of the problem lies in the two-pronged approach of determining the needs of each county's system and developing a plan of action to satisfy those needs. Alert, capable county road management is a prerequisite.

Can counties organize their efforts so that the pressing road needs can be met? The answer is found in the fact that many counties have fashioned methods of management which produce excellent results; those counties were not afraid to discard practices distinguished only by the fact that they were long-established.

In those counties which have progressed to sound methods, no doubt exists that present and future road demands will be met. Results of those sound road practices have brought prestige to road officials and have won the confidence of road users; thus local control of local roads is assured.

Historically, when counties were organized they were given road responsibility by the state legislatures deliberately and for good reason—to insure local control. Many states enacted a legal framework calling for a county board and specifying the duties of the board and the number of its members. Although provisions vary from state to state, the basic purpose of the law is the same everywhere: to give to the county board the responsibility for representing the people and, in

their names, providing a road system to meet their needs. Within the legal framework, individual road agencies are given varying authority to determine the details of their operations.

The growth of road responsibility for the county board is easily traced. Years ago, road building and management were relatively simple; roads were primitive, constructed with much the same methods and tools as those used by colonial settlers. Counties at first were divided into small road districts. Adjacent property owners often manned the construction and maintenance crews. The advent of motorized travel changed the type of roads needed and revolutionized construction methods. And, over the years as improvements were made in road equipment, materials and methods, road building and maintenance became a specialized field.

These changes, coupled with the necessity for planning roads on a county wide basis, resulted in more and more responsibility being placed on road agencies and their duties becoming increasingly complex.

This article to this point has been taken, with but a few adaptations, from a recent publication of the National Association of County Officials. Responsible people in and interested in local government all over this country are saying the same thing: county-wide planning of roads is necessary. But what is county highway planning? What will it do and how do you do it?

County highway planning is first of all a most important function of a county highway department and the one which is seldom utilized by the counties of Indiana.

What is county highway planning? It is the orderly and continuing collection of information about county highways, including their history, condition, use, effects, costs and needs, and the analysis of these data for the efficient and economic development of the highway system through highway classification, priority determination and improvement programs. The objective of county highway planning is the establishment of a network of county highways capable of accommodating all highway travel in an orderly, safe, efficient and economical manner. This is also the objective of the county commissioner and county road supervisor.

What are the tools of highway planning? They are many but let's discuss a few fundamental ones. A question which county commissioners are continually being called upon to answer is "Where are we going to 'black-top' roads this year?" This is one of the most important questions to the commissioner, to the residents of the county, and to the voters of the county. Every person, it seems, wants the road

past his house 'black-topped' and will insist that the road past his house carries a lot of traffic and is in real need of improvement. Can the commissioners hard surface all the roads which they are requested to surface? Of course, they cannot; there simply is not that much money available.

How then can one determine which roads to 'black-top'; how can one make sure that the roads which are being surfaced are the most deserving ones in the community? There is only one way—through county highway classification and priority determination, both based on facts.

COUNTY HIGHWAY CLASSIFICATION

Most highway engineers and administrators will agree that it would not only be unnecessary but also completely undesirable to build and maintain all county highways as high-type pavements. Indiana counties have not, nor can they expect to possess, sufficient funds, equipment, materials, and manpower to undertake a highway program of such magnitude. Consequently, it is necessary that the various highways be designated according to their respective importance. The importance of a given highway will vary among different individuals as their dependence on that highway varies, so it is essential that any designation or classification of county highways be made in the public interest.

Before county highways can be classified into various systems, it is necessary to determine how many different systems are practical and necessary. A careful consideration of Indiana governmental, financial, and physical conditions has led to the conclusion that three systems of county highways are most desirable. The degree to which a highway fulfills the primary purpose of county highways, which is to serve local traffic, abutting property, and the community, is used for classifying the rural road as a county primary highway, a county secondary highway, or as a local service highway. The ultimate objective of any classification system is to provide a coordinated arrangement of state, county primary, county secondary, and local service highways which will adequately provide for the present and foreseeable future travel needs of the county.

Traffic volume and character of use should be major factors in the classification of county highways because nearly all Indiana county highway revenues are derived from highway user imposts. On the other hand, the effect of abutting property cannot be completely ignored because of the direct relationship between land use and traffic generation. Community interest is indicated by the service provided by the highway. This service may be measured by a study of the areas or

locations which are linked together by the road. Service routes or special use made of the highway may also warrant consideration.

Only a minimum number of miles of county highways should be placed in the county primary and county secondary systems. This is essential because with limited funds, the mileage of routes requiring high design standards must be limited.

Future growth and development must also be evaluated in order to provide a coordinated highway plan which will provide for future as well as current requirements.

BASIC TRAFFIC INFORMATION IS ESSENTIAL

Before a county highway can be classified or evaluated, it is essential that information is available concerning the volume and character of traffic using the road. In 1937, the Indiana State Highway Planning Survey published traffic volume maps showing the daily volume for all county roads in almost every county. Current maps may be developed by collecting volume data from a few properly selected field stations and by a study of the development which has occurred since 1937. The latter study requires observation of all areas where development is presently occurring. Information on the present character and wear of road surfaces is also often an indicator of traffic volume. Some roads have been classified as Federal Aid Secondary Routes for reasons of their importance and information on this System should also be obtained and utilized.

Average daily traffic volumes are generally used to provide limits for design standards. One common practice for local roads is to provide reasonably high standards for average volumes in excess of 400 vehicles per day, intermediate standards for average volumes between 100 and 400 vehicles per day, and lower standards for average volumes less than 100 vehicles per day.

DETERMINATION OF ABUTTING LAND USE

The necessity for any county highway is directly related to the manner in which the land adjacent to the highway is used. Thus, roads passing through highly productive farmland may have high seasonal, but low annual traffic volumes; while roads through relatively poor farmland, which has been subject to suburban residential development, may serve high daily volumes of traffic. Cultural institutions such as schools are handicapped if the highways serving them are impassable much of the time. Roadside parks and other recreational facilities may be used by highly concentrated traffic volumes only during favorable weather conditions, thereby causing greatly fluctuating traffic volumes on their access roads.

Information concerning frequency and type of roadside development is obtained in the field and compared with existing records.

DETERMINATION OF COMMUNITY INTEREST

Community interest may be indicated by the area or locations connected by the highway. A road may serve as a vital connecting link between a small community and a large city or a major traffic artery. Another road may carry high volumes of traffic between two state routes or connect an important or productive area with a distribution center or access highway. This information may be obtained from a study of local land use maps, population maps, and a knowledge of local conditions.

The importance of the various types of service routes such as school or commercial bus, rural mail, milk collection, or heavy trucking routes using the highway varies in each county. Local school, commercial bus, mail, trucking, and other officials should be consulted for service route information.

THE COUNTY PRIMARY SYSTEM

Certain highways, because of their location in the county and method of construction, may have average daily traffic volumes ranging from about 400 vehicles a day to several thousand vehicles a day. These roads may serve to connect a large city with a smaller rural community, or they may serve as a vital connecting link between two state highways or to connect highly productive areas with the highway. Such highways are the type to be considered for inclusion in the county primary system. This system should constitute 10 to 15 per cent of all mileage in the county.

THE COUNTY SECONDARY SYSTEM

Roads which carry traffic volumes ranging from 100 to 400 vehicles a day generally belong in the county secondary system. The service provided by the roads, such as connecting less important communities with each other and/or with higher classification roads or highways, should also be considered. This system, too, should be comprised of 10 to 15 per cent of all mileage in the county.

THE LOCAL SERVICE SYSTEM

All remaining low traffic volume rural roads, which, as the designation implies, carry low daily volumes of usually less than 100 vehicles per day and which primarily serve only the local area, are classed as local service roads. These roads, in general, do not directly serve as

many people nor as much of the county and, consequently, may have a lower design standard.

VIGO COUNTY HIGHWAY CLASSIFICATION

Purdue University, through its extension services in the Joint Highway Research Project, recently completed a county highway classification study for Vigo County. The resulting County Highway Classification System is shown in Fig. 1 and the System will be described as an example of county highway classification.

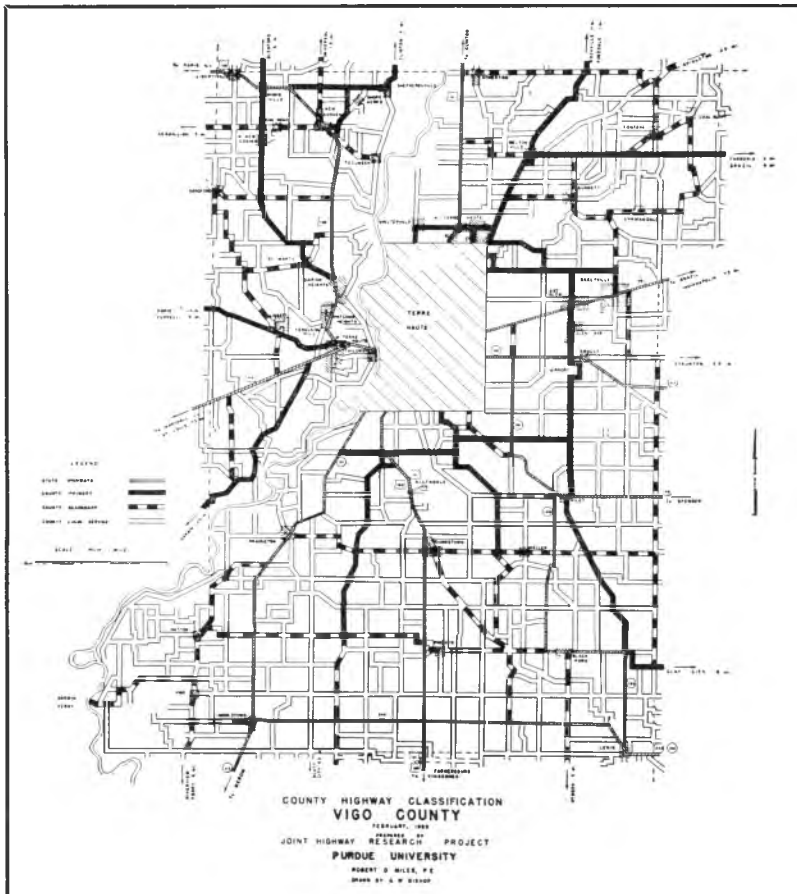


Fig. 1. An example of county highway classification for a county in Indiana.

Vigo County, with an estimated 1958 population of 105,160, is served by approximately 100 miles of state highway that essentially

radiate from the county seat of Terre Haute which has an estimated population of 72,890 or about 70 per cent of the total county population. In general, a state highway is within a distance of eight miles or less of all county residents. Supplementing this system is the county highway system of approximately 1000 miles.

THE COUNTY PRIMARY HIGHWAY SYSTEM

The primary highways are so designated because their location in the county, type of construction, and character of traffic use make them logical routes to be developed for the flow of high volumes of mixed traffic. Most of the Vigo County primary highways are radial routes, which either connect communities within the county or communities outside of the county to Vigo County communities. One route is essentially a circumferential highway around Terre Haute on the north, east, and south. This route, with its primary connections to Terre Haute, should assist in distributing the traffic to and from Terre Haute to other primary and secondary county highways or the state highways. It also serves the major areas of development within the county.

Of the 1006.5 miles of total rural highways in Vigo County, only about 89 miles or 8.9 per cent of the total are classified as county primary highways. These highways should be developed to relatively high standards, and the roadway surface, shoulders, right-of-way, bridges and traffic control devices should be designed to provide adequate service and safety for the motoring public. In general, the county primary highways will be the preferential county roads for traffic flow purposes and each major intersection must be investigated for proper signing.

As of February 1959, 62 miles or 70 per cent of the County Primary Highway System were constructed with hard surface roadway varying from low type bituminous surface to high type concrete pavements.

THE COUNTY SECONDARY HIGHWAY SYSTEM

The County Secondary Highway System of about 143 miles or 14.3 per cent of the rural mileage is so designated because these roads generally serve as feeder roads to the County Primary and State Systems and carry less traffic than the county primary highways. The current traffic volume on roads in this system is usually more than 100 vehicles per day. They also connect small rural communities with each other and/or with county primary or state highways. Ultimately, as traffic volumes increase because of continued development in these areas, some

of the roads in this system may warrant inclusion within the County Primary System.

As of February 1959, 57 miles or about 40 per cent of the County Secondary Highway System were surfaced, in general with an intermediate or low type bituminous mix.

THE LOCAL SERVICE HIGHWAY SYSTEM

The Local Service Highway System is composed of the remaining 774.5 miles of the rural roads in Vigo County. This System comprises 76.8 per cent of the total county road mileage. Approximately 36 miles or about 5 per cent have been surfaced with bituminous mixtures.

These roads, as the name implies, serve local areas and usually carry low volumes of traffic of less than 100 vehicles per day and frequently less than 50 vehicles per day. Road sections in this System do not serve as many people nor as much of the county as do roads in the other two county highway systems. Consequently, local service highways need not be built to as high standards as the roads in the County Primary and County Secondary System.

GENERAL COMMENTS ON CLASSIFICATION

A relatively small mileage of county roads has been classified in the County Primary or County Secondary Systems because this mileage, combined with the state highways, is adequate to serve the needs of county residents. These systems of highways should be developed rapidly to adequate standards. These are the roads which should be given maximum consideration for improvement during the next few years. A summary of the miles of road in each System in Vigo County as of February 1959 is given in Table 1.

Table 1
Classification of County Highway in Vigo County

Classification	Mileage	Percent	Hard Surfaced*	
		Total Mileage	Mileage	Percent
County Primary	89.0	8.9	62	70.0
County Secondary	143.0	14.3	57	40.0
Local Service	774.5	76.8	36	5.0
Total	1006.5	100.0	155

* As of February 1959.

THE HIGHWAY INVENTORY

Following or in conjunction with the classification study, an inventory of the county highway system needs to be made. An accepted and valuable business practice is that of conducting periodic inventories in order to determine the current status of the business. The

county highway administrator, like his commercial counterpart, should have a vital interest in knowing the present status of his business—the county road system. Most citizens have definite opinions concerning what is wrong with the county roads and how these faults are to be corrected. Consequently, when county road administrators are forced to allocate funds on the basis of opinions rather than facts, they can usually expect varied amounts of criticism from disappointed petitioners.

Generally, records describing the existing physical conditions of the county road system are inadequate and inaccurate. It is therefore essential that the initial inventory be as complete and precise as possible. All pertinent information—such as highway number or name; right-of-way, shoulder, and roadway widths; roadside culture; type and condition of the pavement and surface; topography; horizontal alignment; passing sight distance; stopping sight distance; safe driving speed; and gradient—should be recorded. This record will not only provide county road administrators with a factual record of essential road information, but the location and extent of critical conditions are readily evident. It is imperative, therefore, that the county highways be properly identified through an accepted rural road identification system.

INVENTORY PROCEDURES

One or more three-man “logging” crews are used to obtain the factual data such as widths, types, etc. One “rating” party may then complete the information, such as condition and adequacy comments, for all the highways. The number of logging parties depends on the available manpower and time, but should be kept to a minimum in order that comparable information may be obtained. Only one rating party should be used to insure the relative evaluation of all highways. Forms for the inventory can be readily developed for the specific conditions of each study.

COUNTY HIGHWAY STANDARDS

The next step in orderly development of the county highway system is the development of standards (Design Standards) for the construction or reconstruction of roads and standards of adequacy (Tolerable Standards) by which the adequacy of an existing road can be measured. Although the inventory will provide the highway administrators with facts about the county road network, there still may be considerable question as to what conditions are necessary to provide reasonably satisfactory service. Thus, the administrators are faced with the need for a set of scales with which to measure the ability of a section of highway to provide satisfactory service. The tolerable standards are

Table 2 Minimum Tolerable and Design Standards for Rural County Roads in Indiana

Road Classification	Local service		County secondary		County primary	
	1-99		100-399		400-999	
Average daily traffic volume (veh./day)	Tolerable	Design	Tolerable	Design	Tolerable	Design
Design speed (miles/hour)						
Level.....	35	50	40	60	50	65
Rolling.....	30	45	35	50	45	55
Hilly.....	20	30	30	40	40	45
Minimum width (ft)						
Rt. of way.....	40	50	50	60	60	80
Shoulder.....	4	5	5	6	6	8
Surface.....	18	20	20	22	22	24
Min. sight distance (ft)						
Stopping						
Level.....	240	350	275	475	350	540
Rolling.....	200	315	240	350	315	415
Hilly.....	165	240	200	275	275	315
Passing						
Level.....	700	1400	900	2100	1400	2500
Rolling.....	500	1150	700	1400	1150	1750
Hilly.....	300	700	500	900	900	1150
Degree and radius of sharpest curve (ft)						
Level.....	18° (318)	9° (637)	14° (409)	6° (955)	9° (637)	5° (1146)
Rolling.....	25° (229)	11° (521)	18° (318)	9° (637)	11° (521)	7° (819)
Hilly.....	36° (159)	18° (318)	25° (229)	14° (409)	14° (409)	11° (521)

Table 2 Minimum Tolerable and Design Standards for Rural County Roads in Indiana—Cont.

Road Classification	Local service		County secondary		County primary	
	Tolerable	Design	Tolerable	Design	Tolerable	Design
Average daily traffic volume (veh./day)	1-99		100-399		400-999	
Maximum gradient (percent)						
Level.....	10	7	8	6	7	6
Rolling.....	10	8	10	7	8	7
Hilly.....	12	10	10	8	9	8
Struct.						
Width (feet).....	20	22	22	24	24	28
Loading.....	10 T	15 T	10 T	15 T	15 T	20 T

Note: Standards for the pavement are dependent on many factors which vary locally. Competent professional advice must be obtained to determine this standard.

this set of scales. Roads which do not meet the tolerable standards are inadequate and in need of improvement and when improved would be constructed to the design standards so that they will continue to be adequate for many years to come.

Through cooperative action of many agencies and organizations, tolerable and design standards have been established for all types of rural roads. These standards were studied and in some cases modified so that they represent values which, if followed, would result in economy, usefulness, and longevity in highway improvements. The tolerable and design standards recommended for the three county highway classifications are shown in Table 2. All standards shown are minimum.

Some county officials may hesitate to approve the adoption of design standards such as these because they may appear to be too high. It may be remembered, however, that much of the present congestion on county roads may be attributed to similar arguments of years ago, with the end result that funds were expended on the basis of design standards which the county officials "thought" they could afford. Consequently, the cost of providing an adequate highway is now much greater. The multiple costs of delay and lack of safety which result each year while insufficient standards are utilized must also be considered.

DETERMINATION OF PRIORITY FOR IMPROVEMENT

With an inventory of the roads (what you have) and a set of tolerable standards as to what is adequate (what you should have) the next step is a comparison of the two. Such comparison will show you what the needs are for improvement on the county roads, in other words what improvements are needed to bring the highways to adequacy. Such comparison will show that there are more needs than there is money to eliminate them in one year. The problem then becomes one of determining which roads are most in need of improvement and which roads if improved will provide the maximum in benefits to the most persons.

The next step, therefore, is to assign a priority of improvement to the many sections of road which need improvement.

When one is deciding which of several road sections are in the greatest need of improvement he probably asks himself two questions:

1. Which road is most important to the community?
2. Which road is in the worst condition?

Then his thinking continues. If Road A is the most important to the community and in the worst condition, then Road A should be on top of the list for improvement. But usually the most important road is not in the worst condition. The problem is not that simple.

A method commonly used to guide the road official in answering these two questions utilizes priority ratings. The method utilizes facts about the roads to supplement the good judgment of the road official. It pulls together, in a systematic manner, the facts which will contribute to his judgment.

The details of priority ratings are not difficult. Basically each road is evaluated along with all others in each highway system and each road is rated—giving a numerical rating—as to its importance as a county road, as to its adequacy of condition, and as to its safety. These numerical ratings are made from a study of the facts obtained in the inventory and a comparison with the design standards for roads within that system.

Let's look at some examples:—the Importance Rating (Sometimes called Service Rating) first of all.

Each road in the county is given an importance rating with the most important county road given the highest rating and decreasing ratings given to all other roads depending on their importance. The importance of a county road is evaluated from the facts by measuring the service provided by each road. This is measured by the volume of traffic using the road (certainly a road carrying 600 vpd is more important than one carry 200 vpd) and by the number of service routes (school bus, mail, produce, etc.) it carries, the number of properties it serves (the homes and businesses along) and its use as a connecting link between two important locations (such as two rural communities). Each of the roads—from the facts—is given a numerical value for traffic volume, route service, number of properties served, and connecting link service and they are added for each road to obtain a numerical Importance Rating. The most important road in the county will receive the highest rating.

For example, a "perfect" highway (the most important one in the county from the standpoint of service), will accumulate its Importance Rating of 50 as follows:

1. Traffic Volume, average daily traffic (ADT)	35 points
2. Service Routes (School, mail, milk, etc.)	5 points
3. Number of Properties Served	5 points
4. Service as a Connecting Link	5 points
Total	50 points

Each other road in the county would be evaluated similarly and the various factors listed above would be given a numerical value on the basis of its importance as compared to the "perfect" (most important) road. The numerical value of the least important road may be one (1) or slightly higher.

Each road is then also rated as to its condition and safety from the facts of the inventory and from the standards developed. Under condition, for example, such road elements as right-of-way width, surface width, alignment and grade, smoothness of surface and condition of shoulders, drainage and pavement structure should be rated with each element which is adequate receiving the maximum number of points for that element.

A rating for safety is then also made by considering those road characteristics which result in accidents. A road, for example, which has many sharp curves, poor sight distance, and many entrances and exits along it would be rated poorly on this factor. If accident records are available for a number of years they can be used to make this evaluation. Additional elements can be added to the above and rated if desired. The weighting of these factors may perhaps be best illustrated by indicating how the "perfect road" would accumulate its Condition Rating (sometimes called Road Rating) of 100 points.

1. Widths (25 points max.)		
a) Effective right-of-way width	10	
b) Roadbed width	5	
c) Surfacing (or traveled way, if unsurfaced) width	5	
d) Marginal clearance	5	
	—	25
2. Alignment and Grade (15 points max.)		
a) As affecting safe or attainable speed	5	
b) As affecting stopping sight distance	10	
	—	15
3. Surface Characteristics (10 points max.)		
a) Smooth riding evaluation	5	
b) Raveling evaluation	5	
	—	10
4. Structural Adequacy (35 points max.)		
a) Shoulders	5	
b) Drainage	10	
c) Pavement structure	20	
	—	35
5. Safety (15 points max.)		15
Maximum total	=	100

We now have an Importance Rating and a Condition Rating for each road. These two ratings must then be combined into a Priority Rating.

This priority rating should tell us the relative importance and condition of each road in the county. The most important road if it were in the worst condition should be at the top of the list. The least important road which is in good condition should be at the bottom of the list.

Present practice is to combine these two ratings by use of a formula which provides that roads of low importance rating regardless of condition rating have a low priority rating and that roads with high condition ratings regardless of the importance rating have a low priority rating. A chart which has been prepared for this purpose and which was prepared for the Allen County study by the Joint Highway Research Project is shown in Fig. 2. On the chart the Importance

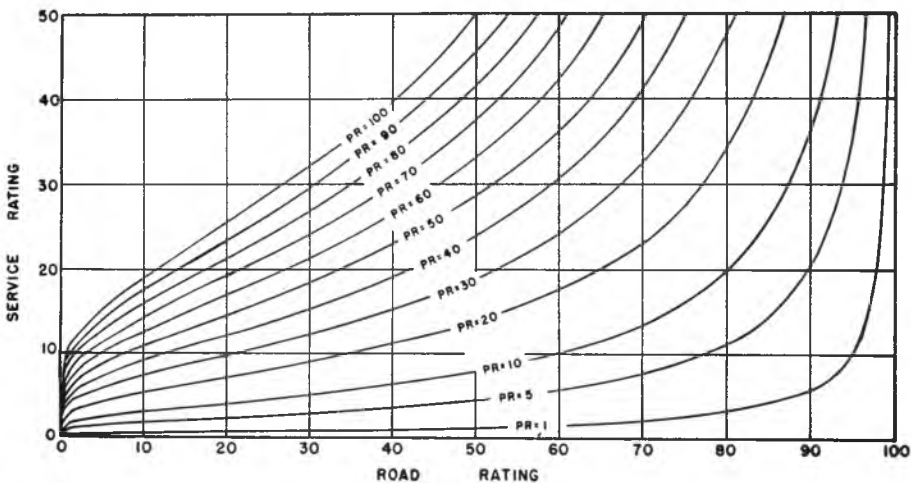


Fig. 2. A priority rating chart developed for a maximum importance (service) rating of 50 and a maximum condition (road) rating of 100.

Rating is referred to as the Service Rating and the Condition Rating is called the Road Rating. It can be used by other counties if the maximum number of points assigned to the Importance (Service) and Condition (Road) Ratings are 50 and 100 respectively.

The result is a priority rating for each section of road in the county, in other words, a listing of the order in which the roads need improvement is provided. The questions of which is the most important road and which is in the worst condition have been answered by facts.

ROAD IDENTIFICATION

Another sign of good county road management is a sound and orderly system of county highway identification. Descriptions of real estate in both urban and rural areas have followed accepted practices for reasons of legality, ownership, taxation, and others. In addition, the naming of streets and the numbering of houses and business units in urban areas have been a necessity and a convenience for many years. Usually the naming and numbering have been done in an orderly and systematic manner, but little has been done in rural areas except for the naming and, more recently, the numbering of the principal rural highways.

The rapid development of motor vehicle transportation and the desire for more effective rural development and better community services in the counties of Indiana have increased the need for an orderly method of identifying local roads and homes in rural areas. Among the community services to benefit from such a procedure are the public utilities, fire protection, medical and veterinary aid, all types of delivery routes, and others of similar character. Improvement of the accounting and cost control methods of the county highway department is another benefit to be received through better identification.

A county road system that will provide for better community services and the general improvement of the area will require proper identification of local roads and rural dwelling units and an effective system for accounting and cost control.

A uniform system of identification and control is desirable. Each county should serve as a basic unit, but identification methods should be uniform for all counties in the state. If the specifications and methods are uniform, the residents in one county can easily interpret the county road marking and dwelling unit numbering in adjacent or distant counties.

The establishment, use, and evaluation of accounting and cost control procedures that are uniform throughout the state, will facilitate the work of the State Board of Accounts and assist the county officials who are responsible for the planning and programming of an effective system of rural roads.

The identification and location of county roads relative to established base lines in each of the 92 counties of Indiana may be accomplished in a manner similar to that used for state highways, but certain basic characteristics of the local-road problem must be considered in the development of the procedure.

In general, the character of travel on the local-roads is predominately intra-county, but it includes some inter-county and interstate move-

ment. Most of this local-road travel is to-and-from the county seat, or other trade areas in the county, and in adjacent counties. The patchwork of short-section and variable-direction local-roads does not always lend itself to the development of continuous routes within a county or between counties.

Thus, it is desirable that the methods used for identification and relative location of roads and in the numbering of rural homes should be closely associated with the character of the travel on these roads, be county-wide and uniform throughout the state, provide for continuity with adjacent counties when possible, and employ engineering survey techniques.

LAND SURVEY PRINCIPLES FOLLOWED

Fundamental guides in the development of a uniform system of rural road marking and dwelling unit numbering are found in the principles of the U. S. Land Survey. The State-Wide Highway Planning Survey, conducted in Indiana in the late 1930's, used these basic principles in the development of the General Highway and Transportation Maps of the 92 counties. In this study, similar principles were used to establish the base lines needed in the development of the method for rural road and home identification.

In applying these principles to naming and numbering, each county of Indiana is divided into four quadrants, as illustrated in Fig. 3, Recommended Base Lines for Rural Road Marking. The base lines of the quadrant coincide with a projection of the Range and Township line intersection near the center of each county.

Fig. 3 illustrates how the intersections of Range and Township lines near the center of each county in Indiana coincide with section lines, and, when extended to each county boundary, they form the baselines of the North-East, North-West, South-East, and South-West Quadrants of the county. Many of the intersecting range and township lines are relatively close to the county seats, and when feasible, coincide with the base lines of adjacent counties to provide for continuity.

This continuity is also illustrated in Fig. 3 where the Second Principal Meridian forms the range base lines in Clinton, Boone, Hendricks, Morgan, Monroe, Lawrence, Orange, and Crawford counties. It also shows continuity of township base lines in LaPorte, St. Joseph, Elkhart, LaGrange, and Steuben counties. Additional examples of continuity may also be observed.

If roads are located along all or part of the east-west and north-south base lines, they are designated as Division Road and Meridian Road, respectively.

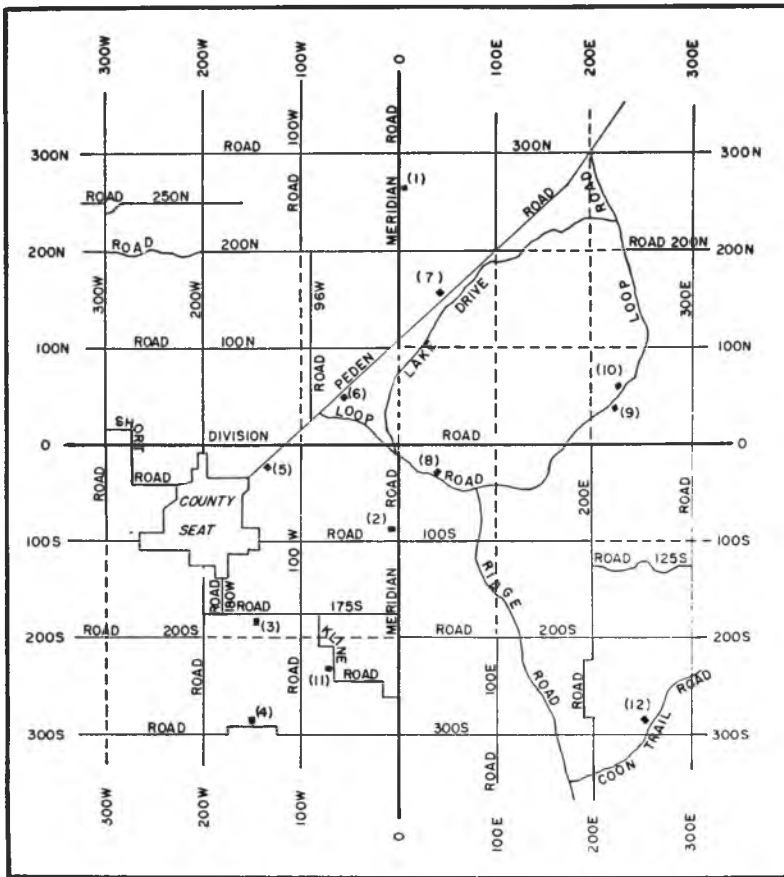


Fig. 3. Recommended base lines for rural road marking.

ROADS NUMBERED BY DISTANCE

Section line roads and others paralleling these base lines form a rectangular coordinate system with Division Road and Meridian Road

serving as base lines, as illustrated in Fig. 4, Examples of Road and House Designations. The numbers assigned to these section line roads



- | | |
|------------------------------|---------------------------------------|
| (1) 263N MERIDIAN ROAD | (7) 151N 43E PEDEN ROAD (0E) |
| (2) 88S MERIDIAN ROAD | (8) 28S 39E LOOP ROAD (0E) |
| (3) 144W ROAD 175S | (9) 39N 222E LOOP ROAD (0N) |
| (4) 151W ROAD 300S | (10) 51N 230E LOOP ROAD (0N) |
| (5) 21S 134W PEDEN ROAD (0S) | (11) 238S 69W KLINE ROAD (175S) |
| (6) 52N 56W PEDEN ROAD (0W) | (12) 285S 252E COON TRAIL ROAD (300S) |

Fig. 4. Examples of road and house designations.

and other parallel roads represent the progressive distance of each road from the base lines.

The first section line parallel to a base line is designated by the number 100, followed by the letter of direction (N, S, E, or W) from the base line. Thus, the first section east of the north-south line

(Meridian Road) is designated as 100 E, and a road along that section line is designated as Road 100 E. Similarly, a section line road 3 miles south of the east-west base line (Division Road) would be designated as Road 300 S.

Roads parallel to the base line roads, but located between section lines, are assigned their relative position and number by dividing each section (about one mile) into one-hundredths of a mile. Progressive numbers are assigned to show the position relative to sections and approximate distance from the base lines. Thus, a road along a quartersection line that is about $1\frac{3}{4}$ miles south of the east-west base line (Division Road) would be designated as Road 175 S.

SPECIAL "PROBLEM" ROADS

Diagonal, curving, and jogging roads present a problem because they change direction, and, thus it is difficult to assign a distance number or direction letter to all segments of the road. The following general principles should be used when applicable:

1. Roads with irregularities of less than one-tenth of a mile from the normal east-west or north-south location should carry the same number designation throughout, as illustrated by Roads 300 S, 200 N, and 125 S in Fig. 4.

2. If an individual straight-line jog in an east-west or north-south road exceeds one-tenth of a mile, it should be considered as a separate road and assigned a number, as illustrated by Road 96 W, and by jogs 30 N, 75 N, and 270 E in Fig. 4.

3. Loop roads formed by slight deviations due to topographical and cultural barriers should be considered as straight roads, as illustrated by the loop formed near the intersection of Road 250 with Road 300 W in Fig. 4.

4. Roads with irregularities, except for a single straight-line jog, exceeding one-tenth of a mile from the normal east-west or north-south location should be named, as illustrated by Peden Road, Loop Road, and Kline Road in Fig. 4.

Where an east-west, north-south, or variable direction road coincides with a road in the state highway system, the legend of the intersection sign should also include the number of the State Highway route.

Each county should number (and name when necessary) all roads within the county and the county line roads (and houses) on its south and west boundaries. Counties adjacent to Illinois, Michigan, and Ohio may assign the name State Line Road to boundary roads.

SIMILAR SYSTEM FOR HOUSE NUMBERS

House numbering is accomplished through application of the basic grid system used in road identification. Thus, the house numbering system gives the relative position of the rural residences to about the nearest one-hundredth of a mile from the section lines.

It must be remembered that the last two digits of a house number refers to hundredths of a mile in a section and that digits to the left represent section lines to the nearest whole mile. For example, the number 1225 E means that the house is about 12 and 25/100 miles east of the base line. In this example the direction letter designation in the house number, when combined with the direction letter designation in the road number, indicates the quadrant of the county in which the house is located.

Houses along east-west or north-south roads could be assigned true coordinate positions, but they would be easier found if numbered as follows:

1. Odd-hundredths (29, 201, 325) are assigned to houses on the North or East side of a road.
2. Even-hundredths (30, 202, 324) are assigned to houses on the South or West side of a road.

Examples 1-4 of Fig. 4 illustrate the method of numbering houses on roads classified as east-west or north-south roads.

House numbers on diagonal, curving, and jogging roads follow the distance and position concept used in the location and numbering of roads, as illustrated in Fig. 4. The rectangular coordinate system is applied with equal facility to roads of variable direction. The application of this system, calibrated to the mile, tenth of a mile, and one-hundredth of a mile gives the distance and direction of a house relative to the base lines.

Example (5) of Fig. 4 illustrates how a house at that position on Peden Road is assigned the number 21S 134W Peden Road. The 21S indicates that the dwelling unit is about 21/100 miles south of Division Road, and the 134W indicates that it is about 1 and 34/100 miles west of Meridian Road. Examples (6-12) also illustrate how houses on variable direction roads are assigned numbers by this method.

The assignment of odd or even numbers on diagonal roads, as prescribed for numbering houses on east-west or north-south roads, is not practical. The true coordinates, however, give the position relative to the base lines and permits easy location.

MINIMUM STANDARDS FOR ROAD SIGNS

Road signs should conform with standards suggested in the "Manual on Uniform Traffic Control Devices for Streets and Highways". The following minimum standards are suggested to provide for economy of design and for uniformity, legibility, and visibility of the signs:

Color and Visibility of Sign

Black letters or numbers on a white background are recommended. The signs should be reflectorized, and at critical intersections they should also be illuminated.

Legend

The letters or numerals of the primary legend should be at least 4 inches high, while those of the secondary legend (supplementary name) should be at least 2 inches high. The size, shape, and spacing of the letters and numerals should conform to the standards available from the Bureau of Public Roads.

Sign Plate Specifications

A horizontal rectangle, with a minimum height of 6 inches, is required for signs limited to a primary legend. The height must be 9 inches when a secondary legend is used. The length may vary from 18 inches to 30 inches, depending upon the legend. Sheet iron or steel signs should be 18 gage or heavier, depending upon size and rigidity desired; other materials should have sufficient rigidity. Double-faced signs should be used.

Mounting Height

Road-side conditions will, in general, have a significant effect upon the mounting height of the signs. The signs should be mounted on a fixed metal post. In rural areas the lower edge of the signs should be not less than 5 feet above the maintained edge of the road surface; in suburban or other areas under the jurisdiction of the counties, where obstructions may be caused by parking, a minimum elevation of 7 feet above the road or curb is required.

Sign Location

For intersections with average daily traffic volumes in excess of 250 vehicles per day, signs should be placed on diagonally opposite corners so that they will be on the far right hand side of the intersection for traffic on the more important road. Signs indicating both roads should be erected at each location. In general, they should be placed not less than six feet nor more than 10 feet from the maintained edge of the road, and should be placed as close to the corner as practicable, facing traffic on the cross road.

At intersections with less than 250 vehicles per day, signs indicating both roads should be placed on the one corner with the greatest visibility.

A priority of erecting signs should be adopted by the county. Roads which perform the greatest community service should be marked prior to those of lesser importance.

Financing Road Marking

The cost of adequate signs and road markings and of proper maintenance is estimated to be about one or two per cent of the annual county budget for highways. This financing may be accomplished by county appropriation of funds, service club project, commercial development, or other methods.

Maps indicating county road markings and house numbers should be prepared in accordance with the established principles. It is reasonable to assume that directories of rural residents might serve a useful purpose and that the sale of maps and directories could aid in financing the project.

All records of operation, construction, and maintenance of county roads should be in accordance with the principles of road marking and house numbering. Accounting and cost control records that are easily applied to the county road or parts thereof are essential to adequate road planning and programming.

CONCLUSION

Many county officials in discussing county highway planning say, "We haven't enough money to do all these things." But county highway planning is not expensive and it will save the county thousands of dollars in the future. In fact, when funds are in short supply is the most logical time to plan better, to use the funds available better, and to avoid costly errors—it is the time for a high degree of efficiency.

Some county officials may feel they are doing the things discussed in this paper. If they are, they are doing good county planning and they can answer yes to the following questions:

1. "Are the roads of your county classified? That is to say are they divided into groups according to importance or purpose, whatever these groups may be called, so that a basis is established for priority of improvement, standards to be achieved, and method of finance?"
2. "Is your county road system inventoried? That is to say, does the county know exactly what road system it has, and some-

thing about its condition, and is this information kept up to date?"

3. "Does your county have a plan and a program, are they being continually revised, and is there sufficient record keeping to permit planning and programming with realism?"
4. "Is there a definite set of standards to which various types of road facilities will be constructed?"
5. "Are your county roads identified? That is to say, are they adequately named and properly marked according to a logical organized system?"

If the answer is yes to all these questions that county does have the basic tools of good county highway road management. If the answer is no to any of these questions, the county officials of that county should consider whether they are managing the highways of that county as they should be managed.

ACKNOWLEDGMENTS

The material contained in this paper is an adaptation of much material which has previously been published. It has been combined here to serve as a ready reference for those concerned with highway planning. The author acknowledges the work of the following individuals and their indicated publications and wishes to give them their due credit for the material contained in this paper:

1. *County Road Management Relations*, Report of the Special Joint Committee of County Commissioners and County Engineers, National Association of County Officials, Washington, D. C., August, 1958.
2. *Priorities for Local Rural Road Improvements*, by James W. Spencer and Olin K. Dart Jr., Department of Agricultural Engineering, N. Y. S. College of Agriculture, Cornell University, Ithaca, N. Y., September, 1957.
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4. "Progress Report on County Road Marking," by A. K. Branham and J. E. Baerwald, *Proceedings of the 40th Annual Purdue Road School*, Extension Series No. 86, Vol. 38, No. 4, pp. 117-130, July, 1954.
5. "Vigo County Highway Classification," by R. D. Miles, unpublished report of the Joint Highway Research Project, Purdue University, March 25, 1959.

6. "A Case for Improvement of County Highway Administration," Special Report Prepared by Frank C. McAlister, Director Transportation Department, Indiana State Chamber of Commerce, June, 1958.